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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/388,989 09/02/99 COHEN B AMAT/3191

IM22/1027

PATENT COUNSEL MS 2061
LEGAL AFFAIRS DEPT
APPLIED MATERIALS INC
3050 BOWERS AVENUE
SANTA CLARA CA 95054

EXAMINER

PADGETT, M

ART UNIT

PAPER NUMBER

1762

6

DATE MAILED: 10/27/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

07/388,989

Applicant(s)

Cohen et al

Examiner

M.L. Padgett

Group Art Unit

1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

- ☐ Responsive to communication(s) filed on 12/14/99 + 3/6/00
- ☐ This action is **FINAL**.
- ☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- ☒ Claim(s) 1-20 is/are pending in the application.
Of the above claim(s) _____ is/are withdrawn from consideration.
- ☐ Claim(s) _____ is/are allowed.
- ☒ Claim(s) 1-20 is/are rejected.
- ☐ Claim(s) _____ is/are objected to.
- ☐ Claim(s) _____ are subject to restriction or election requirement.

Application Papers

- ☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
- ☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.
- ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.
- ☐ The specification is objected to by the Examiner.
- ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

- ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
 - ☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been received.
 - ☐ received in Application No. (Series Code/Serial Number) _____
 - ☐ received in this national stage application from the International Bureau (PCT Rule 1.7.2(a)).

*Certified copies not received: _____

Attachment(s)

- ☒ Information Disclosure Statement(s), PTO-1449, Paper No(s) 3 ☐ Interview Summary, PTO-413
- ☒ Notice of Reference(s) Cited, PTO-892 ☐ Notice of Informal Patent Application, PTO-152
- ☒ Notice of Draftsperson's Patent Drawing Review, PTO-948 ☐ Other _____

Office Action Summary

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1. Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The process steps of claim 1 are not commensurate in scope with their preamble, as no metal is ever deposited, hence it is unclear whether or not the claimed process actually is supposed to include any metal deposition.

Claims 2, 7 and 15 are ambiguous, because it is unclear what is intended by "a pre-clean chamber". Is the chamber pre-cleaned? Or is it merely used for what's already been claimed as being done?

Claims 4 and 16 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Since independent claims 1 and 14 require "hydrogen and helium" (emphasis added), broadening the scope of the dependent claim to include the possibility of only H with no He is not further limiting. Alternately, it make the meanings of all the independent claims uncertain, as it ^uwould appear that part "b)" is intended to include the possibility of using only H₂ or He.

Claims 6 and 12 part (b) "RF power" and "RF bias" need to either have an article showing their antecedent basis in part (a), or they need to be differentiated therefrom. Claims 11-12 and 18, suggest the latter, and also need correcting.

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Claim 10 is vague and indefinite because it contradicts part (c) which requires “a metal on the patterned dielectric layer” (emphasis added). This also makes when this step is done is unclear.

In claim 12 “the inductive coil” (lines 3-4) lacks proper antecedent basis due to inconsistent terminology. Also since the units for bias (RF bias) are NOT Watts, claims 12 and 18 are confusing, such that the patentability of these claims may depend on their clarification.

In claims 13 and 19 “each plasma” does not use a proper article for showing antecedent basis, while in claim 20, “a pressure” in lines 1 and 2, appear to need differentiating, because they are not the same.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-11, 13-17 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoo et al in view of Zhao et al.

After patterning a dielectric layer, Yoo et al teaches two plasma etching steps, before metalizing, where a Ti/TiW(barrier) layer may be deposited before the Al. First an Ar plasma etch (1 or 2 minutes) with exemplified RF powers of 400W, which smooths sharp corners on the patterned dielectric layer, there may then follow a reactive ion etch of less than about 60 sec.,

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where He plus a reactive gas, exemplified by CF_4 or CF_3H , when removes material at the bottom of the contact openings. Yoo et al differs from the claims by not teaching H_2 as their active gas, and not giving all the parameters for their plasmas.

Zhao et al teaches an Ar plus H_2 plasma using ratios of H_2 to Ar flow rate that maybe 1:20 to 100:1, RF powers of 20-400 W and D.C. bias on substrates, that will clean, ie etch, the bottoms and side walls at the bottoms of high aspect ratio vias, hence it would have been obvious to one of ordinary skill in the art the H_2 was a reactive gas that could have been used equivalently in the process of Yoo et al, in their second plasma step, that uses He + reactive gas, because it was shown to produce like effects in analogous situations and configurations. Power parameters Zhao et al would have been expected to be applicable to the second plasma of Yoo for these alternative gases, and while D.C. bias is discussed in Zhao et al, the examiner takes notice that D.C. and R.F. voltages of like absolute values may generally be applied equivalently for acceleration of ions. Applicant gives bias in Watts, hence these can not be compared to the parameter of volts, however it is noted that for the first plasma of Yoo et al, Ar+ is desired to be used sputtered etching, which is generally known to be most efficiently preformed using bias. While unlike Zhao who combines the sputter etch and active etch, Yoo et al does the "soft" reactive etching second, where the reactive gas as discussed in both references will react with what's at the bottom of the via, and remove redeposited material on sidewalls (Zhao), hence as this is descriptive of an isotropic type process, no or less bias would ^{have been} be desirable than in the first, Ar

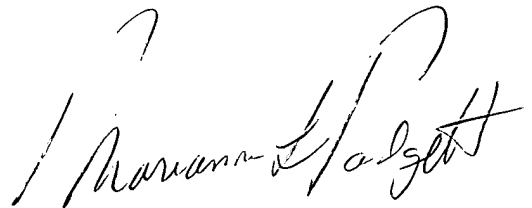
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plasma, since it is desirable to etch in more directions than down. Overall power in put would obviously need to be maintained in order to maintain the plasma.

4. The patents to Webb, Brar et al, Agustino et al, Phillips, Myers and Polak are of interest for teaching various plasma cleaning techniques intended to be applied to dielectric materials, before metal is deposited thereon.

5. Any inquiry concerning this communication should be directed to M.L. Padgett at telephone number (703) 308-2336 and FAX #*703) 305-5408 (official) and 305-6078 (unofficial).

M.L. Padgett/om
October 25, 2000

A handwritten signature in black ink, appearing to read "Marianne Padgett", with a large, stylized initial "P" at the end.

**MARIANNE PADGETT
PRIMARY EXAMINER
GROUP 1700**